**STUDENT ACTIVITY GUIDE**

**WHAT AFFECTS YEAST GROWTH?**

***Taken from IFT Experiments in Food Science Series***

**ACTIVITY OBJECTIVE**

In this activity, you will (1) determine what factors affect the growth of yeast cells during

fermentation, and (2) observe that one by-product of the fermentation process is carbon dioxide

(CO2).

**MATERIALS REQUIRED**

Safety goggles

125-mL Erlenmeyer flasks or small (8-oz) glass soft-drink bottles

Balloons, 7.8-cm (7-inch) size

Table sugar (sucrose)

Fructose, Maltose, and Dextrose

PH paper - Sensors

markers

Masking tape

Large bottle or 16 packages of rapid-rise yeast

Vinegar

Ammonia

Clock or stopwatch

Warm water bath (40°C and 80°C)

Triple-beam balances or scales

100-mL graduated cylinders

Eyedropper

Thermometers

Pipettes /syringe

**BACKGROUND INFORMATION**

Yeasts are microscopic organism in the kingdom Fungi. They exist naturally on the surface of the earth. They are noted for their ability to ferment carbohydrates to produce various food products, including bread, beer, wine, and cheese. During fermentation, yeast cells convert complex sugars into simple sugars, which are further hydrolyzed into CO2 and ethyl alcohol (ethanol). Yeast growth is affected by several factors, including temperature, pH, and nutrient content.

**EXPERIMENTAL PROCEDURE**

**Group 1 – Temperature Experiment**

Label flasks A through D. Add 80 mL of tap water (neutral pH only) to each flask and place the

flasks in the following conditions:

Flask A – in ice bath.

Flask B – at room temperature.

Flask C – in 40°C water bath.

Flask D – in 80°C water bath.

Dissolve 5 g of sucrose in each flask. Add 4 g of rapid-rise yeast to each flask and stir. Then

place a balloon on each flask and seal it securely with masking tape. Periodically stir the

contents by spinning the flask slowly.

**Group 2 – Water Activity Experiment**

Label flasks E through H. Add 80 mL of 40°C water (neutral pH only) to each flask and dissolve

the following amounts of sucrose in each:

Flask E – 0 g (water only)

Flask F – 5 g

Flask G – 30 g

Flask H – 50 g

Add 4 g of rapid-rise yeast to each solution and stir. Then place a balloon on each flask and seal

it securely with masking tape. Periodically stir the contents by spinning the flask slowly.

**Group 3 – pH Experiment**

Label flasks I through L. Add 80 mL of tap water (neutral pH only) to each flask and add

vinegar or ammonia to adjust the pH as shown below. Use pH paper/meter to verify the pH.

Flask I – add vinegar to adjust the pH to 3.

Flask J – add vinegar to adjust the pH to 5.

Flask K – add vinegar or ammonia to adjust the pH to 7.

Flask L – add ammonia to adjust the pH to 10.

Dissolve 5 g of sucrose in each flask and warm the solutions to 40°C. Add 4 g of rapid-rise yeast

to each solution and stir. Then place a balloon on each flask and seal it securely with masking

tape. Periodically stir the contents by spinning the flask slowly.

**Group 4 – Nutrient Experiment**

Label flask M through P. Add 80 mL of tap water (neutral pH only) at 40°C to each flask and

dissolve 5 g of each of the following sugars:

Flask M – fructose

Flask N – glucose

Flask O – sucrose

Flask P – lactose

Add 4 g of rapid-rise yeast to each solution and stir. Then place a balloon on each flask and seal

it securely with masking tape. Periodically stir the contents by spinning the flask slowly.

**All Groups – Observations**

1. After 15 minutes, record initial observations in the table provided for each test.
2. Make additional observations at 10-minute intervals, and final observations. These

observations should include a description of the fermentation activity and a measure of

the amount of gas produced, either by measuring the actual volume of gas produced (see

ancillary activities below) or by measuring the circumference of the balloon. To measure

the circumference, wrap a string around the balloon at its widest point, then measure the

length of the string.

3.Using the supplied graph paper generate bar graphs of balloon circumference (or cm3 of gas produced) against each of the following:

**X-axis = independent variable; y-axis = dependent variable**

Temperature

PH

Type of Sugar

Water activity

**PRE-LAB QUESTION: On a separate sheet of paper, TYPE your response. To be turned in at the start of Lab**

1**.** Based upon everything that you have learned in biology, predict the results of each of the experimental situations. Using scientific knowledge, explain the logic used to come up with your prediction. [4 predictions total]

**QUESTIONS: On a separate sheet of paper TYPE your responses. Please use complete sentences.**

1. What observations did you make about the flasks prior to the addition of the yeast?

2. Which flasks showed the greatest yeast growth, i.e., most production of CO2 gas?

3. Did the contents of the flasks look and smell the same at the end of the test time? Why?

4. Which were the most favorable conditions for growth?

5. Which were the least favorable conditions for growth?

6. How does the result of this experiment support the concept of homeostasis?

**Staple together your Data Sheet, Graphs and Response to the questions.**